



A.D. 1854 N° 2167.

SPECIFICATION

OF

JOSEPH BURDEKIN JACKSON
AND
WILLIAM BOWLER.

FURNACES OR FIRE-PLACES.

L O N D O N :

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Furnaces or Fire-places.

LETTERS PATENT to Joseph Burdekin Jackson, of Etna Works, Sheffield, in the County of York, and William Bowler, also of Sheffield, both Engineers, for the Invention of “**IMPROVEMENTS IN FURNACES OR FIRE-PLACES, AND IN THE PREVENTION OF SMOKE.**”

Sealed the 29th December 1854, and dated the 10th October 1854.

PROVISIONAL SPECIFICATION left by the said Joseph Burdekin Jackson and William Bowler at the Office of the Commissioners of Patents, with their Petition, on the 10th October 1854.

We, **JOSEPH BURDEKIN JACKSON**, of Etna Works, Sheffield, in the County
5 of York, and **WILLIAM BOWLER**, also of Sheffield, both Engineers, do hereby declare the nature of the said Invention for “**IMPROVEMENTS IN FURNACES OR FIRE-PLACES, AND IN THE PREVENTION OF SMOKE,**” to be as follows:—

This Invention relates to the so arranging the furnaces or fire-places of steam
boilers and other apparatus, that great economy in the consumption of fuel may
10 be secured, in combination with the prevention of smoke. At the extreme front
end of the furnace seat or mounting, and beneath the fire-door, is a weighted
valve or hinged plate, so set as to possess a tendency to remain open for the
admission of the external air to pass beneath an inclined metal plate set under
the fire bars. This inclined plate extends the whole distance from the front
15 valvular aperture through the ash-pit space to the back end of the grate, and

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it receives the hot cinders and ashes as they fall from the grate above. The inner end of the plate is connected to a cross bearer of metal, lined with fire bricks, and answering as the support for the further or inner end of the fire bars, and forming the front bridge for spreading the flame and gases. The bottom of the ash-pit is curved upwards from the front to the base of a second 5 bridge, set parallel to the first, but far enough back to leave a space for the passage up between the two bridges of the air as heated beneath the inclined plate. The heated air is thus directed upwards to meet the unconsumed gases passed from the burning fuel over the first bridge, and the joint current then proceeds onward over the second bridge, complete combustion being insured 10 here. An additional contrivance is provided for excluding the atmospheric air when the smoke has passed away. The weighted valve for the air passage has attached to one of its spindles or stud centres a slotted crank piece, through which is passed the lower end of a pendant rod, carrying a moveable stud for adjustment. When the attendant fires, he draws down this pendant 15 rod, when the weight on the valve causes it to open to admit air; or, instead of this plan, the opening of the fire doors may be made to open the air valve. The upper end of the connecting rod is attached to a "cataract" arrangement, as employed in mining engines, and as the rod is drawn down, the inner case of the cataract is lowered. This inner case has a hole through the centre of 20 the valve, so that after being drawn down it rises gradually again, in consequence of the weight being slightly heavier than the rod, &c. at the other end; the length of time that the valve shall remain open, to be regulated by the size of the hole through the valve.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed 25 by the said Joseph Burdekin Jackson and William Bowler in the Great Seal Patent Office on the 9th April 1855.

TO ALL TO WHOM THESE PRESENTS SHALL COME, we, JOSEPH BURDEKIN JACKSON, of Etna Works, Sheffield, in the County of York, and WILLIAM BOWLER, also of Sheffield, both Engineers, send greeting. 30

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Tenth day of October, in the year of our Lord One thousand eight hundred and fifty-four, in the eighteenth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto us, the said Joseph Burdekin Jackson and William Bowler, Her special 35 license that we, the said Joseph Burdekin Jackson and William Bowler,

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our executors, administrators, and assigns, or such others as we, the Joseph Burdekin Jackson and William Bowler, our executors, administrators, or assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and
5 lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN FURNACES OR FIRE-PLACES, AND IN THE PREVENTION OF SMOKE," upon the condition (amongst others) that we, the said Joseph Burdekin Jackson and William Bowler, by an instrument in writing under our
10 hands and seals, or under the hand and seal of one of us, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

15 **NOW KNOW YE**, that we, the said Joseph Burdekin Jackson and William Bowler, do hereby declare the nature of our said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement in writing, reference being had to the accompanying Drawings, and to the letters and figures marked thereon,
20 that is to say:—

Our said Invention relates to the so arranging the furnaces or fire-places of steam boilers and other apparatus, that great economy in the consumption of fuel may be secured, in combination with the prevention of smoke. At the extreme front end of the furnace seat or mounting, and beneath the fire
25 door, is a weighted valve or hinged plate, so set as to possess a tendency to remain open for the admission of the external air to pass beneath an inclined metal plate set under the firebars. This inclined plate extends the whole distance from the front valvular aperture through the ash-pit space to the back end of the grate, and it receives the hot cinders and ashes as they fall
30 from the grate above. The inner end of the plate is connected to a cross bearer of metal, lined with fire bricks, and answering as the support for the further or inner end of the fire bars, and forming the front bridge for spreading the flame and gases. The bottom of the ash-pit is curved upwards from the front to the base of a second bridge, set parallel to the first, but far enough
35 back to leave a space for the passage up between the two bridges of the air as heated beneath the inclined plate. The heated air is thus directed upwards to meet the unconsumed gases passed from the burning fuel over the first bridge, and the joint current then proceeds onward over the second bridge, complete combustion being insured here. An additional contrivance is pro-

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vided for excluding the atmospheric air when the smoke has passed away. The weighted valve for the air passage has attached to one of its spindles or stud centres a slotted crank piece, through which is passed the lower end of a pendant rod, carrying a moveable stud for adjustment. When the attendant fires, he draws down this pendant rod, when the weight on the valve causes it 5 to open to admit air; or, instead of this plan, the opening of the fire doors may be made to open the air valve. The upper end of the connecting rod is attached to a "cataract" arrangement, as employed in mining engines, and as the rod is drawn down, the inner case of the cataract is lowered. This inner case has a hole through the centre of the valve, so that after being drawn 10 down, it rises gradually up again.

And in order that our said Invention may be properly understood, we shall now proceed to describe the several explanatory Figures on the Sheet of Drawings hereunto attached.

Figure 1 on the Sheet of Drawings is a front end elevation of an exter- 15 nally-flued cylindrical steam boiler, as fitted up with our improved furnace arrangement; and Figure 2 is a vertical longitudinal section of the furnace, corresponding to Figure 1. Figure 3 on the same Sheet of Drawings is a front end elevation of a cylindrical boiler, with internal furnace and flue, as fitted with a modification of our improved air-supplying contrivances. Figure 4 20 is a vertical transverse section, corresponding to Figure 3, and taken through the grate space; and Figure 5 is a vertical longitudinal section, corresponding to Figures 3 and 4. We have selected the two arrangements of boiler and furnace, represented in the Drawings hereunto attached, in explanatory illustration of our Invention, as being sufficient to indicate to the practical 25 engineer the general mode of working out the improvements. We would, however, remark, that our Invention is applicable, with suitable modifications of the minor details, to all descriptions of furnaces; not only to such as are connected to steam boilers, but also to other furnaces or fire-places, as, for example, reverberatory and rolling-mill furnaces. In the arrangement repre- 30 sented in Figures 1 and 2 on the Sheet of Drawings, a valve A, capable of turning upon a horizontal spindle, is fitted up in a valvular aperture extending across the front end of the furnace space. Air is admitted by this valve, and flows along the inclined space covered in by the sloping iron plate B, which is of the full width of the ash-pit, and is inclined upwards towards its inner 35 end to within a few inches of the rear end of the furnace bars C. The inner end of the plate B is supported by a bracket piece or cross bearer D, lined with fire brick, and also answering as the support for the further end of the fire bars C; behind, this cross bearer D is carried up to form the front

FIG. 1.

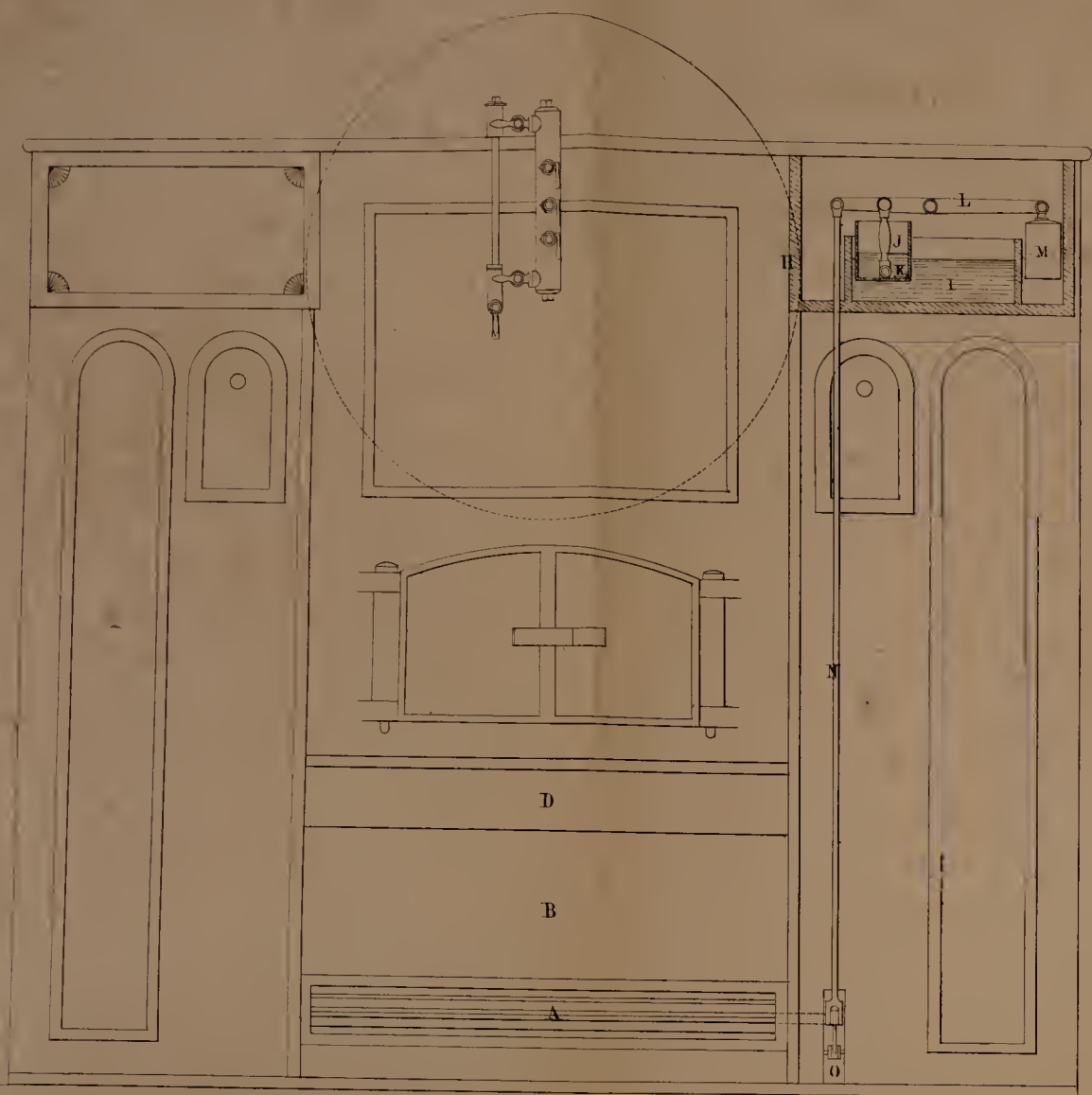


FIG. 3.

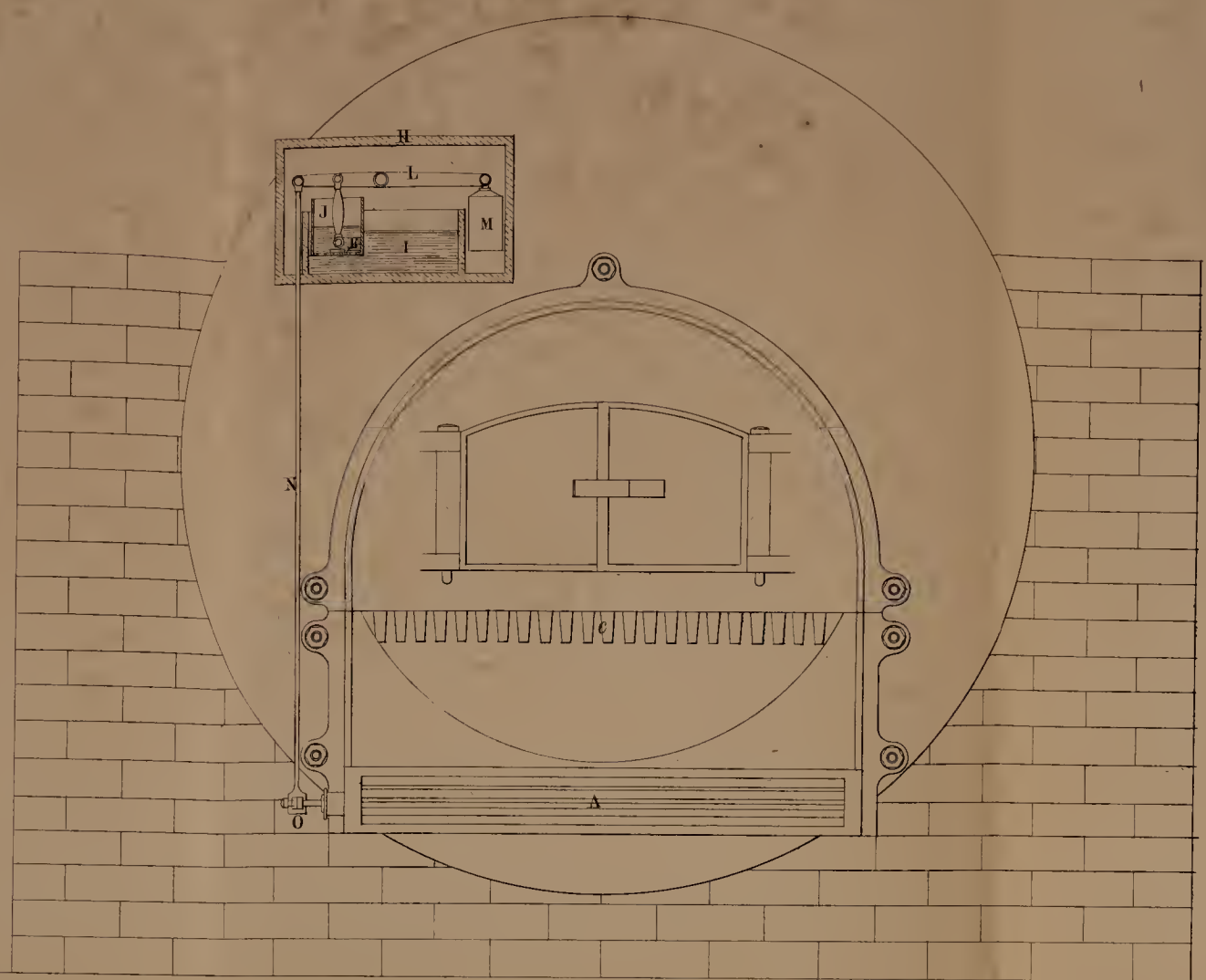


FIG. 4.

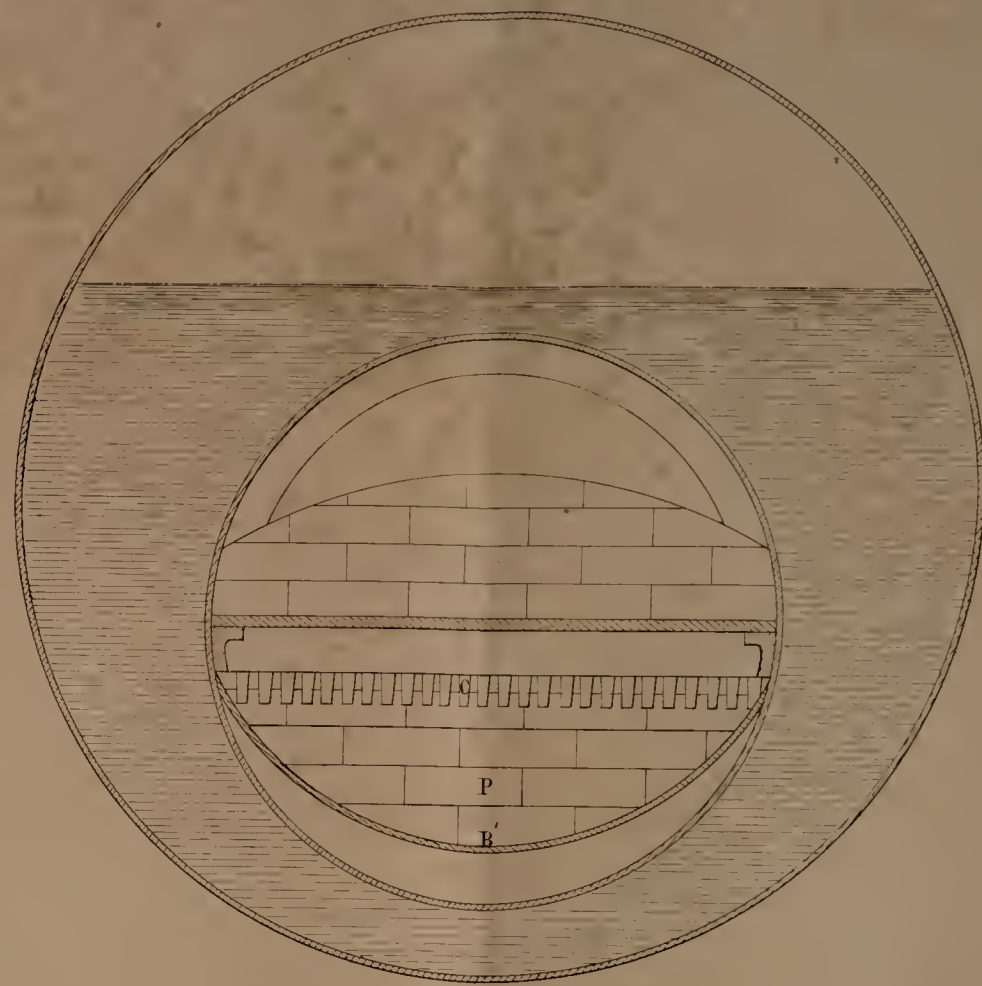


FIG. 2.

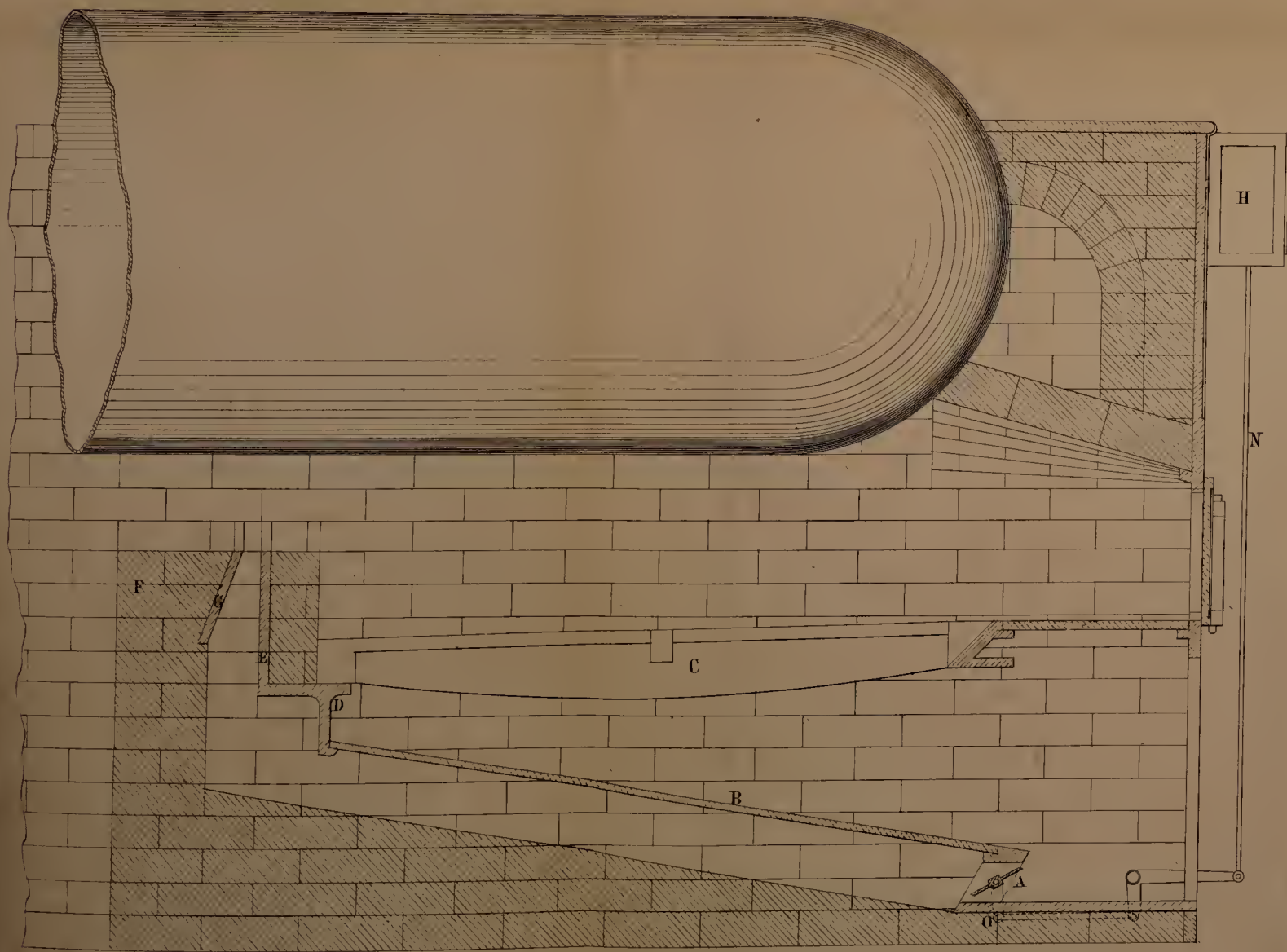
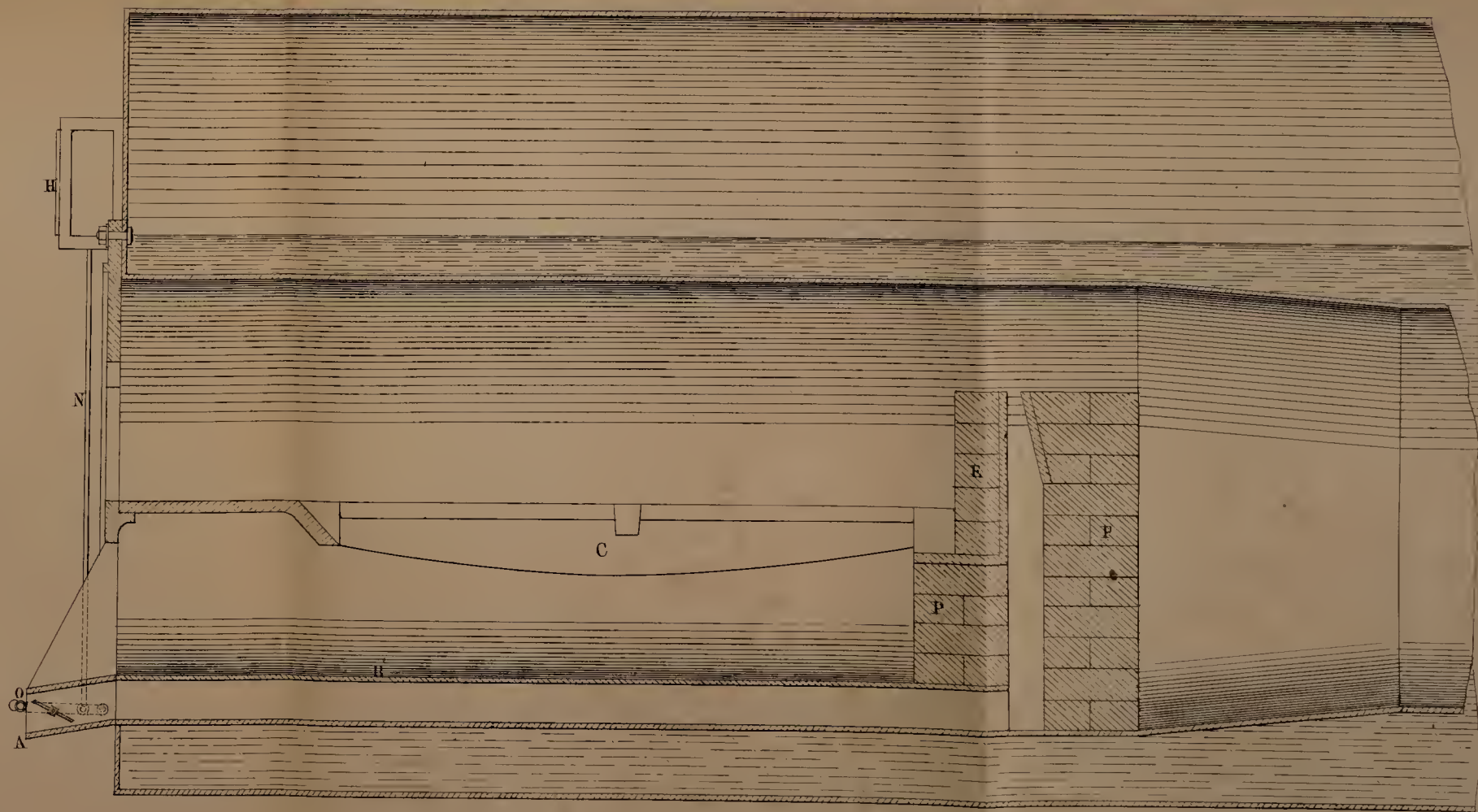
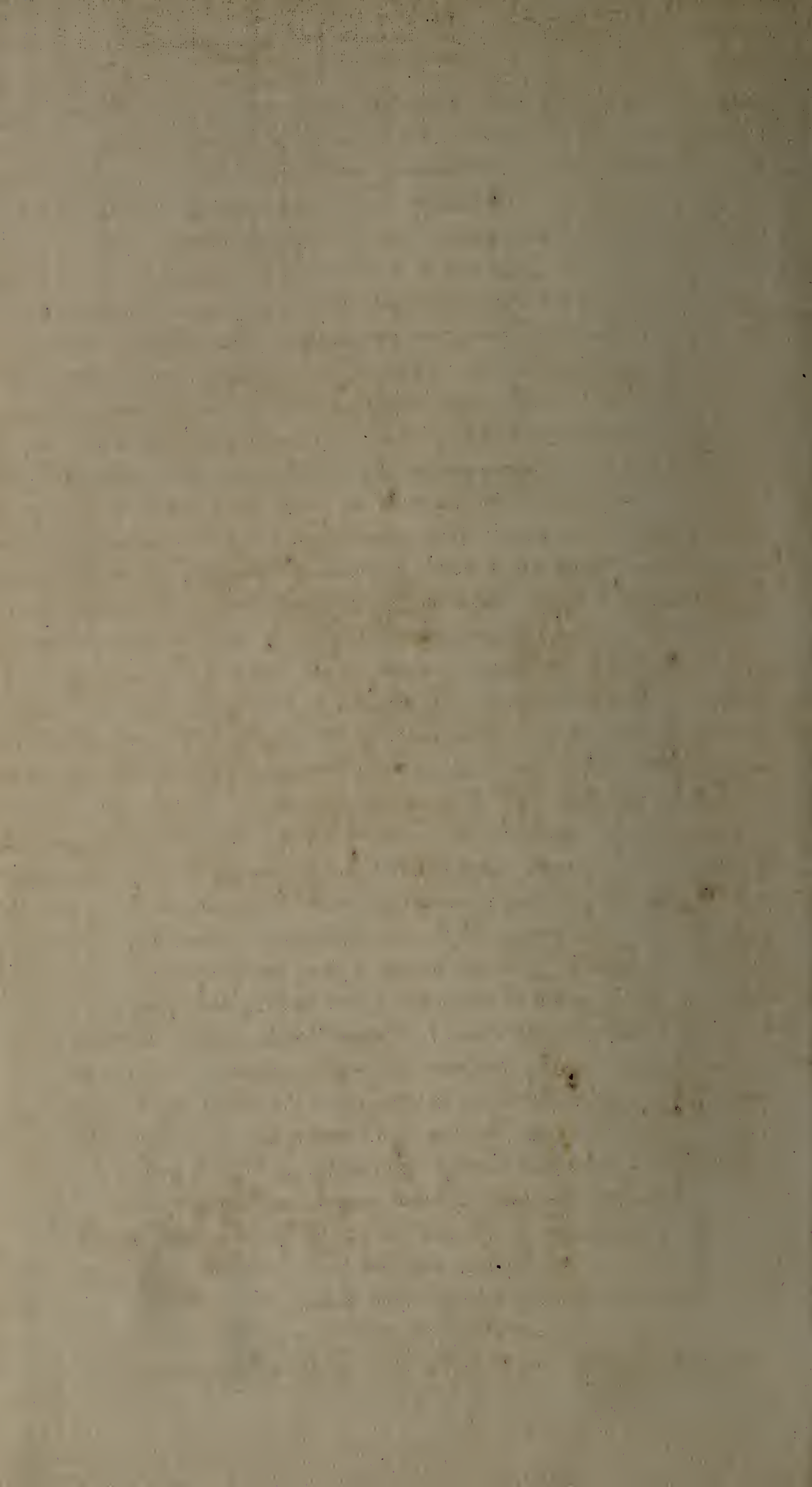


FIG. 5.





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bridge E, for spreading the flame and gases passing off from the furnace. The bottom of the ash-pit all along beneath the plate B is inclined upwards, parallel to the plate, and terminates behind in a vertical wall, forming a secondary bridge F. This secondary bridge is set far enough behind the
5 front one to allow of the passage between of the air current. The upper part of the inner face of the bridge F is fitted with an inclined metal plate G, by which the air current is directed slightly back at an efficient angle for meeting the as yet unconsumed gases from the furnace. The supply of air in at the valve A, and up between the bridges E, F, is regulated by an automatic or
10 partially automatic contrivance, consisting of a species of water "cataract" apparatus, contained in a box or chamber H, which may be fixed upon the front of the boiler, as represented in the Drawings, or in any other convenient situation. The box H is formed with an internal compartment I, to contain water or other liquid, and in this compartment is an open-topped vessel J, in
15 the bottom of which are a valve K, opening upwards, and a small orifice, through which last any water in the vessel J slowly finds egress into the vessel I. The vessel J is connected to a lever L, which oscillates on a centre fixed to the side of the box, and has a weight M jointed or suspended to one end, whilst its other end is jointed to a rod N, passing through the bottom of
20 the box H down to a lever O, fixed on the spindle of the valve A. When the attendant fires, he draws down the rod N, thereby opening the valve A to admit an increased supply of air to the back end of the furnace, and at the same time forcing the then empty vessel J down into the water; or, instead of this piece of separate attention, the rod N may be put in communication
25 with the fire door in such a manner that the opening of the latter will draw down the rod. The descent of the cataract vessel J causes it to be filled with water by the valve K. The air supply is then gradually reduced, and finally stopped by the elevation of the vessel J, this causing the valve A to gradually close. This lifting of the vessel J is caused by the weight M, which has just
30 sufficient power for the purpose, the water gradually passing out of the vessel J by a small orifice in its bottom, or in the centre of the valve K, and by its weight preventing the too rapid action of the weight M. In the modification of boiler and furnace, represented in Figures 3, 4, and 5, on the Sheet of Drawings, the same general arrangement of the details of the air-
35 supplying contrivances is adopted as in the modification represented in Figures 1 and 2, just described, and we have indicated corresponding parts in the two modifications by the same letters of reference. On account, however, of the curved or cylindrical form of the ash-pit of the boiler, represented in Figures 3, 4, and 5, a flat plate, as B, in Figures 1 and 2, could not

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be employed for partitioning off the air passage along the bottom of the ash-pit without taking up too much space, and a curved or bent plate B¹ is accordingly used for this purpose. For a similar reason, the curved plate B¹ is not represented as inclined upwards towards the back. It may, however, be so inclined, if thought desirable, and if the ash-pit space is sufficiently large. If the plate B is formed without any inclination, the space P at its inner end, between it and the inner ends of the fire bars C, is filled up with brickwork, which forms a portion of the front bridge E; or the space P may be filled up in any other convenient manner, so as to form a passage upwards for the air current in front of the secondary bridge F. The details of the apparatus for regulating the action of the valve A (Figures 3 and 5) is precisely the same as that already herein-before described in reference to Figures 1 and 2 of the Sheet of Drawings.

Having now described and particularly ascertained the nature of our said Invention, and the manner in which the same is or may be used or carried into effect, we may observe, in conclusion, that we do not confine or restrict ourselves to the precise details or arrangements which we have had occasion to describe or refer to, as many variations may be made therefrom without deviating from the principles or main features of our Invention; but what we consider to be novel and original, and therefore claim as the Invention secured to us by the herein-before in part recited Letters Patent, is,—

First, the general arrangement and construction of machinery, apparatus, or means to be applied to furnaces and fire-places for the prevention or better consumption of smoke, as herein-before described.

Second, the system or mode of supplying air to furnaces and fire-places for the prevention or better consumption of smoke, by means of a passage or passages along the bottom of the ash-pit, opening into the main flue immediately behind the fire space, and furnished with an automatic or partially automatic valve or valves, for regulating the supply of air, as herein-before described.

In witness whereof, we, the said Joseph Burdekin Jackson and William Bowler, have hereunto set our hands and seals, the Seventh day of April, One thousand eight hundred and fifty-five.

JOSEPH BURDEKIN JACKSON. (L.S.)

WILLIAM BOWLER. (L.S.)

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